

only one glacial period and that the disappearance of palæolithic man from Northern Europe was principally due to the submersion of the greater part of the land beneath the water of an immense freshwater lake or sea, at or a little before the culmination of the ice age. If Mr. Geikie's views should be ultimately accepted, the term "inter-glacial" will be most appropriate; but should, as I hope and believe, mine be proved to be nearer the truth, I should prefer to use the term "pre-diluvial" instead of "pre-glacial," as heretofore, to express the age of palæolithic man.

THOMAS BELT

The Cedars, Ealing, June 22

Will you kindly allow me to correct an apparent breach of official etiquette and act of discourtesy in my last week's letter? I should have said that only two geologists prominently interested in the question at issue had seen my evidence; for, of course, Mr. H. W. Bristow, F.R.S., Director of the Geological Survey of England and Wales, has been kept fully *en rapport* with my work, and has several times visited me at Brandon. I am anxious that no statement of mine should appear to slight so eminent a geologist and so considerate a friend.

Brandon

SYDNEY B. J. SKERTCHLY

Colour-Sense in Birds—Blue and Yellow Crocuses

UNLESS your readers are quite tired of the subject, may I add a fact which will be subversive of a good deal that has been written about yellow crocuses and sparrows. I dislike yellow crocuses, and four seasons since planted some hundreds of blue and white in the garden underneath my windows. For two seasons they flowered in beautiful profusion. In 1876 the sparrows for the first time destroyed these flowers completely. I allowed the roots to remain for another year—viz., 1877—but they suffered the same usage, hardly a single flower being left uninjured. So complete was their destruction that I have had the roots dug up.

I regard the proceeding as an imitative one; blue and white crocuses, not being common in the vicinity, were new to the sparrows, and until one more experimental than the rest attacked them they were safe.

A similar result will occur with domestic pigeons; if reared exclusively with small grain, as wheat and barley, they will starve before eating beans. But where they are thus hungry, put a bean-eating pigeon amongst them, and the habit is immediately propagated.

I have seen fowls refuse maize at first, but on seeing others eat it, they follow suit, and become excessively fond of it.

W. B. TEGETMEIER

Purple Verbenas

HAVING now read for the first time the letters in NATURE regarding the preference that sparrows show for the yellow crocus, it might perhaps help to elucidate the problem were it known that the choice of colour is not only confined to birds, as a few years ago our garden was infested by rabbits and there was a row of eight beds planted in turn, with white, red, and purple verbenas. The flowers of the red and white were eaten close off, whilst those of the purple were never touched. This happened three years running, since which, the garden, being protected by wire netting, has remained undamaged.

A. M. DARBY

Japanese Mirrors

YOUR correspondents, Messrs. Atkinson, Highley, and Darbishire, have referred to several conjectures and experiments respecting the curious Japanese mirrors and the patterns they reflect. None of these gentlemen have, however, referred to the suggestion offered by Sir David Brewster in the *Philosophical Magazine* for December, 1832. In this paper Sir David drew attention to some similar phenomena in the light reflected from the surfaces of burnished buttons of metal, arguing that in the mirrors (of which at that time he apparently had seen no actual specimen) there were slight actual inequalities of surface, artificially produced, but concealed from observation by their slowness of depth and by the brightness of the polish. This, of course, may

be independent of the particular figures raised in relief on the back, as in the case cited by Mr. Darbishire; and so thought Sir David, for he added:—

"Like all other conjurers, the artist has contrived to make the observer deceive himself. The stamped figures on the back are used for this purpose. The spectrum in the luminous area is *not an image of the figures on the back*. The figures are a copy of the picture which the artist has drawn on the face of the mirror, and so concealed by polishing that it is invisible in ordinary lights, and can be brought out only in the sun's rays."

I trust Mr. Atkinson may be able to learn in Japan the real process of manufacture of these curious toys. Meanwhile are there not specimens in many of our museums that would repay examination? Were there not some amongst last year's exhibits at the Loan Collection of Scientific Apparatus?

SILVANUS P. THOMPSON

University College, Bristol, June 25

NOTE ON THE ELECTRICAL DISTURBANCE WHICH ACCOMPANIES THE EXCITATION OF THE STIGMA OF *MIMULUS LUTEUS*

MANY years ago my attention was drawn to the excitatory-contraction exhibited by the lipped stigma of *Mimulus luteus*, the structure of which I then gave an account of in the *Proceedings* of the Edinburgh Botanical Society. In connection with my recent investigation of the excitatory variation in *Dionæa* I have, during the last few weeks, in co-operation with Mr. Page, made experiments for the purpose of ascertaining whether in this organ, as in the leaf of *Dionæa*, the change of form provoked by mechanical stimulation is accompanied by a similar electrical disturbance.

Mimulus luteus is a favourite window plant on account of its showy flowers and the facility with which it can be cultivated. The mechanism of the contraction of the stigma can be best studied in the inferior of the two lobes, of similar size and form, of which the organ consists. In the unexcited state, when the flower is in full bloom, this lobe is curled outwards. The curling outwards is due, as I long ago observed, to the turgidity of the layer of loosely connected conducting cells, ending in papillæ, which constitute the stigmatic surface. So long as this tissue is turgid the elastic lamina by which it is backed is prevented from straightening itself, so that the whole lobe forms a scroll of which the axis is transverse. The effect of touching any part of the lobe, and particularly the papillary surface, is to diminish the turgidity of the tissue, as the result of which the organ slowly expands so as to face and ultimately meet its fellow.

The excitatory change of form which I have described is, as in the case of *Dionæa*, associated with an electrical disturbance of which the following are the most important features:—(1) The sign of the variation is the same as in *Dionæa*, the excited structure becomes negative to the rest of the plant. (2) The extent of variation is somewhat less than in *Dionæa*, the electromotive force developed between the stigma and style being usually about 25-thousandths of a Daniell, whereas in *Dionæa* the variation may amount to from 40- to 50-thousandths. (3) The variation is of relatively long duration; it reaches its maximum at the ordinary temperature of summer, about five seconds after excitation. It subsides at first rapidly, then very gradually, so that the effect may not have entirely passed off until two or three minutes have elapsed.

As in *Dionæa*, the period of electrical disturbance is shortened by increase of temperature. Thus in five stigmas in which the period was measured at 20° C. (68° Fahr.) and at 37° C. (98° Fahr.), the mean duration of the interval of time between the commencement of the electrical disturbance and the moment at which it began to subside was 6.2 sec. at the higher temperature, and 3 sec. at the lower.

In general, the stigma, when in the unexcited state, is positive to the style. As, however, it can be shown that other factors, not concerned in the excitatory process, are operative in the production of this result, not much importance is to be attached to it.

I send this short note in order that physiologists interested in the subject may be able to repeat the observations during the present season.

University College,
June 27

J. BURDON-SANDERSON

TAUNTON COLLEGE SCHOOL

THE circumstances alluded to last week, under which the Taunton College School is threatening to collapse, and is in immediate danger of losing the head-master who has made it what it is, are interesting on public grounds to the advocates of scientific instruction, as well as to the general educationalist. In a pamphlet published in 1865, and containing letters from Dr. Daubeny, Prof. Phillips, and Dr. Acland, Mr. Tuckwell was, we believe, the first English schoolmaster to assert publicly the claims of science to an honoured place in the curriculum of all first-class schools; and his evidence before Lord Taunton's Commission, his papers read to the British Association in 1869 and 1871, and his communications to the Royal Science Commission, show how diligently he has for twelve years past been working out in his school at Taunton the many practical problems which beset the introduction of a new subject into an ancient, established, jealous system. The school has thriven in his hands, risen rapidly in numbers, and gained the highest public distinctions at the Universities, the India Civil Service, Cooper's Hill, and Woolwich; and though the short-sighted economy of his governing body left him for years without a science master or a laboratory, and refused him a museum, botanical garden, and science class-rooms, he has overcome all these difficulties by patience, by the munificence of friends, and by pecuniary sacrifices; and at this moment many distinguished scientific visitors are glad to testify to the completeness of a system which passes the whole school through a course of physics and chemistry, and includes physical geography, botany, and meteorology in its more special training. In 1875 the number of boys had risen to 120, but the thrift of the governing body kept down the number of the masters. The typical proportion of assistant-masters to boys in modern schools of this size is one in sixteen; the Taunton masters were only one in twenty-seven. The school could not continue to succeed under this policy; the masters were unequal to the work; the number of boys fell off until a visitation of fever brought them below the paying point, and the school, already heavily in debt, was on the point of being closed. The panic-stricken officials laid the blame upon the head-master; his theology and politics were pronounced suspect; his unpopularity had caused the falling numbers; and when his friends came forward liberally with money and promises of money the governing body took the money, but upon condition that the head-master should leave at Christmas. Against this parents and old pupils are indignantly remonstrating; both have sent to Mr. Tuckwell public addresses of sympathy and confidence; the parents forwarding also a strong protest to the president of the governing body, and in many cases threatening to remove their sons if Mr. Tuckwell goes. So far, however, the custodians of the school's interests show no sign of yielding; it seems certain that the head-master will be turned out, and more than probable that the school may, after all, collapse.

There are two points in this struggle between philistinism and culture on which we should like to dwell, in the interests both of general and of scientific education.

The first is the mischief being worked in the less important first-class schools by the constitution and habits of their governing bodies. These were the pet institutions of the Endowed Schools' Commission. They were to include the educated gentleman of the county and the representative tradesman of the town: the first, rich in recollections of Eton and of Christ Church, was to initiate, develop, control; to support and instruct the head-master; and to keep his *bourgeois* brother straight; while that second-rate but docile coadjutor was to back the enlightenment of his superior, and to reconcile while he typified the democratic feeling so essential, it was thought, to the local popularity of a school. Charming in theory, it was in fact the weak point in the Commissioners' scheme. The feet on which their image had to stand were of iron mixed with miry clay; the two refused to coalesce, and the clay came uppermost. The gentlemen make admirable governors, but they are in London, in Scotland, on the Continent, at Quarter Sessions; and the local men, who are always on the spot, become virtually the governing body. They too frequently know nothing of education. They cannot understand a head-master's ideas and aims; they in too many cases govern the school as if it were a workhouse, and treat the head-master as they habitually treat the master of their union. The world has not forgotten Felsted Grammar School; and the committee of head-masters could tell us of many other cases, less notorious, but not less galling and mischievous. No first-class school can thrive unless its governing body is composed of gentlemen, who understand, as Mr. Walter said the other day at Wellington College, that their first duty is not to interfere with the head-master.

The second point is one which we have often urged before: the opposition offered by many of the clergy to the *Culturkampf*. Of course there are notable exceptions to this incrimination; but the *Viri Obscuri* of Revellius, and the clerical bigots who combined to oppose the new learning of Colet, Erasmus, and More, would recognise their legitimate posterity in those of the present day, who, themselves uneducated even according to the narrow standard of the past, join in denouncing science and unsectarianism as the irremissible sins of a head-master. Bishop Fox, the founder of the ancient school at Taunton, was rattened by the Oxford clergy for forcing the new study of Greek upon his college of Corpus Christi; his representative in Taunton shares his fate to-day, driven from the school which he has refounded for forcing on it the new study of science.

We write in no hope of assisting the head-master, or of educating his opponents into large-mindedness. Mr. Tuckwell will see his schemes collapse, and be parted from the profession in which all eagerly attest his success, and to which he has given the best years of his life. The school will either break up under the irritation of the parents, or its distinctive features will perish with the ruler who called them forth. The order of the old teaching, the assertion of the old theology, will resume their way in Taunton School. Chemistry, and physics, and botany; Shakspeare, and Milton, and Macaulay, and Guizot, will give way to gerund-grinding and Latin verse. Where Wesleyans, Independents, Quakers, Catholics, and Unitarians worshipped in the same chapel and attended the same scripture-classes, sectarian exclusiveness will re-enter its swept and garnished home. We can only chronicle the facts as indicating the obstacles to be met and reckoned with by the pioneers of modern educational progress. We can only express sympathy with the head-master, who will yet find some compensation for his worries in the unusual warmth of testimony contained in the address which first brought these circumstances to our knowledge, and in the consciousness that, having advanced a noble cause, his work will not in the end be thrown away.